

# GEOGREVISE – AQA THE LIVING WORLD

## Improve learning by reducing forgetting using retrieval practice

Retrieval practice involves retrieving and using knowledge. Through thinking about and using what we know we strengthen learning. Low stakes quizzes, flashcards and quick writing can be used to improve learning. We've put together this resource to help you support your child enhance their learning in geography. This GEOGREVISE focuses on the AQA GCSE Geography The Living World unit. Resources to support revision for this unit are available here: [www.internetgeography.net/aqa-gcse-geography/the-living-world/](http://www.internetgeography.net/aqa-gcse-geography/the-living-world/)



## INTRODUCTION TO ECOSYSTEMS

1. What is an ecosystem?
2. Identify three biotic elements of an ecosystem.
3. Identify three abiotic elements of an ecosystem.
4. What is a producer?
5. What is the difference between a primary and secondary consumer?
6. What is a carnivore?
7. What is a herbivore?
8. What is an omnivore?
9. What is a decomposer?
10. Identify one example of a decomposer in an ecosystem
11. Why are decomposers so important for ecosystems?
12. Why is photosynthesis so important in ecosystems?
13. What is a food chain?
14. What is a food web?
15. What is the nutrient cycle?
16. Draw a diagram to show the main features of the nutrient cycle. Include stores and transfers.
17. Give an example of a small-scale ecosystem.
18. Identify a small-scale ecosystem you have studied.
19. Explain how the removal of a primary producer can have an impact on an ecosystem.

## BIOMES

1. What is a biome?
2. Identify three of the world's major biomes.
3. Describe the distribution of the tropical rainforest biome.
4. Explain the distribution of the tropical rainforest biome.

## TROPICAL RAINFOREST CHARACTERISTICS

1. Identify the main layers of found in the tropical rainforest ecosystem.
2. Describe the characteristics of the emergent layer.
3. Describe the characteristics of the canopy layer.
4. Describe the characteristics of the under-canopy layer.
5. Describe the characteristics of the shrub layer.

6. Describe the characteristics of the forest floor.
7. Describe the typical weather and climate of a tropical rainforest ecosystem.
8. Describe three characteristics of soil in the tropical rainforest ecosystem.
9. Why does the tropical rainforest have the greatest biodiversity of all ecosystems?

---

### **TROPICAL RAINFOREST – INTERDEPENDENCE AND ADAPTATIONS**

1. Identify 6 interdependent features of the tropical rainforest
2. Draw a diagram to illustrate how these different features are interdependent.
3. Identify 3 ways vegetation has adapted to the rainforest environment.
4. Explain 3 ways vegetation has adapted to the rainforest environment.
5. Identify 3 ways animals have adapted to the rainforest environment.
6. Explain 3 ways animals has adapted to the rainforest environment.

---

### **TROPICAL RAINFOREST – DEFORESTATION**

1. How has the rate of deforestation changed over time?
2. Identify a tropical rainforest case study you have studied.
3. Identify 4 causes of deforestation.
4. Give a brief description of each cause of deforestation.
5. Identify 4 impacts of deforestation (including both economic and environmental impacts).
6. Explain 4 impacts of deforestation in your case study location.

---

### **TROPICAL RAINFOREST – SUSTAINABLE MANAGEMENT**

1. Identify 3 local strategies that can be used to manage the tropical rainforest sustainably.
2. Explain how two of the above strategies are sustainable.
3. Identify 2 international strategies that can be used to manage the tropical rainforest sustainably.
4. Explain how one strategy identified above is sustainable.

You will have studied either a hot desert or a cold environment for your second ecosystem. Complete the appropriate questions from the two sections below.

## **Hot Deserts**

---

### **HOT DESERTS – THE CHARACTERISTICS OF HOT DESERTS**

1. Describe the location of hot deserts.
2. Describe the typical weather and climate of a desert ecosystem.
3. Describe three characteristics of soil in the desert ecosystem.
4. Why does the hot desert have a low biodiversity compared to other ecosystems?

---

### **HOT DESERTS – INTERDEPENDENCE AND ADAPTATIONS**

1. Identify 6 interdependent features of hot deserts.
2. Draw a diagram to illustrate how these different features are interdependent.
3. What are plants with adaptations which allow them to live in hot and dry conditions known as?

4. Identify 3 ways vegetation has adapted to the hot desert environment.
5. Explain 3 ways vegetation has adapted to the hot desert environment.
6. Identify 3 animals that have adapted to the hot desert environment.
7. Explain 3 ways animals have adapted to the hot desert environment.

---

### **HOT DESERTS – OPPORTUNITIES AND CHALLENGES**

1. Identify the hot desert case study you have studied
2. Describe its location.
3. Identify four development opportunities in the hot desert area you have studied.
4. Explain how two of these provide development opportunities.
5. Identify four development challenges in the hot desert area you have studied.
6. Explain how two of these provide development challenges.

---

### **HOT DESERTS – DESERTIFICATION**

1. Define desertification.
2. Identify four causes of desertification.
3. Explain two causes of desertification.
4. Identify four strategies to reduce desertification.
5. Explain how these strategies reduce desertification.

## **Cold Environments**

---

### **COLD ENVIRONMENTS – THE CHARACTERISTICS OF COLD ENVIRONMENTS**

1. Where are polar environments located?
2. Are average monthly temperatures above or below freezing in polar environments?
3. Where are tundra environments located?
4. Land in tundra environments is permanently frozen. What is this the name for land that is permanently frozen?
5. What type of vegetation is typically found in tundra environments?
6. What are the characteristics of weather and climate in polar regions?
7. What are the characteristics of weather and climate in tundra regions?
8. What proportion of the Earth's surface is affected by continuous or sporadic permafrost?
9. In tundra regions why does water logging occur in the soil for one or two months a year?

---

### **COLD ENVIRONMENTS – INTERDEPENDENCE AND ADAPTATIONS**

1. Identify 6 interdependent features of cold environments.
2. Draw a diagram to illustrate how these different features are interdependent.
3. Identify 3 ways vegetation has adapted to cold environments.
4. Explain 3 ways vegetation has adapted to cold environments.
5. Identify 3 animals that have adapted to cold environments.
6. Explain 3 ways animals have adapted to cold environments.

---

### **COLD ENVIRONMENTS – OPPORTUNITIES AND CHALLENGES**

1. Identify a cold environment case study you have studied
2. Describe its location.
3. Identify four development opportunities in the cold environment you have studied.
4. Explain how two of these provide development opportunities.
5. Identify four development challenges in the cold environment you have studied.
6. Explain how two of these provide development challenges.

---

### **COLD ENVIRONMENTS – THE RISK OF ECONOMIC DEVELOPMENT**

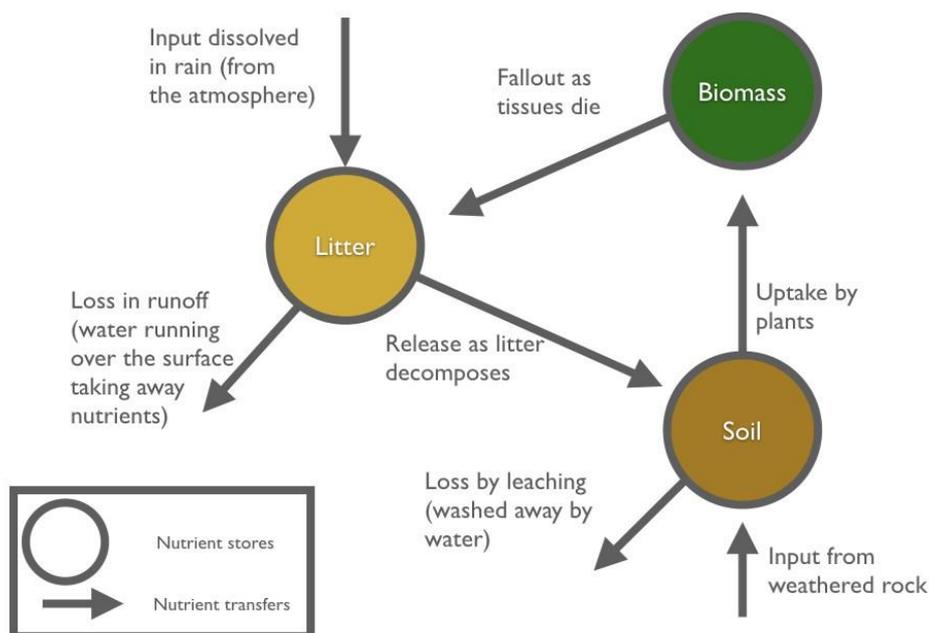
1. Give reasons for the uneven development in the cold environment you have studied.
2. Identify four risks brought by economic development in the cold environment you have studied.
3. Identify four strategies to reduce the risk of economic development in the cold environment you have studied.
4. How can economic development and conservation be balanced using technology?
5. Why are global technology companies relocating to cold environments?
6. Identify ways international solutions attempt to reduce the impact of humans on cold environments.

# Answers

## INTRODUCTION TO ECOSYSTEMS

1. An ecosystem is an area that includes all the biotic (living organisms) parts such as plants and animals and the abiotic (non-living) such as soil, rocks and climate sharing an environment.
2. Any three living organisms.
3. Soil, rock and climate.
4. A producer is an organism that produces its own food, usually by photosynthesis such as trees.
5. A primary consumer is a herbivore that consumes producers. Secondary consumers are carnivores that consume primary producers.
6. A carnivore is a consumer of herbivores (animals).
7. A herbivore is a consumer of primary producers (plants).
8. An omnivore consumes both producers (plants) and animals.
9. A decomposer is an organism that decomposes and breaks down dead plants and animals.
10. Bacteria or fungi.
11. Decomposers are very important for any ecosystem. If they weren't in the ecosystem the plants would not get essential nutrients and dead matter and waste would gather.
12. Without photosynthesis there would be no primary consumers which would lead to the break-down of ecosystems as primary consumers would have no source of energy. Likewise, there would be no food for secondary consumers.
13. A food chain shows the flow of energy from producer to tertiary consumer.
14. A food web shows a collection of food chains.
15. The nutrient cycle shows the transfer of nutrients through an ecosystem.

### The nutrient cycle



 internetgeography.net

- 16.
17. Pond, hedgerow or woods (or any other small scale ecosystem)
18. This will depend on what has been studied but will be a named example.

19. The removal of a primary producer can lead to the collapse of an ecosystem. By removing a primary producer, the food source of primary consumers is also removed which can lead to these organisms dying. In turn this removes the food source of secondary consumers leading to large scale devastation across the ecosystem.

---

## BIOMES

1. **Biomes** are very large ecological areas on the earth's surface, with fauna and flora (animals and plants) adapting to their environment.
2. Any from tropical rainforest, hot desert, taiga, savanna, polar, deciduous forest etc.
3. Tropical rainforests are located between 10°N and 10°S of the Equator where temperatures stay near 28°C throughout the year. Rainforests typically receive over 2000mm of rain each year. The largest rainforests are in the Amazon in Brazil (South America), Democratic Republic of Congo (Africa) and Indonesia (South East Asia). Tropical rainforests are also found in Hawaii and the islands of the Pacific & Caribbean.
4. Tropical rainforests are found near the equator due to the amount of rainfall and the amount of sunshine these areas receive. Most tropical rainforests fall between the Tropic of Cancer and the Tropic of Capricorn. These areas receive more sunlight and the amount of sunlight and intensity of the sunlight the tropics receive doesn't vary much in comparison to other parts of the globe. The high temperatures means that evaporation happens at a fast rate, resulting in frequent rainfall. Also, air is rising due to the Hadley cell resulting in convectional rainfall.

---

## TROPICAL RAINFOREST CHARACTERISTICS

1. Emergent, canopy, under canopy, shrub and ground layer.
2. The Emergent layer consists of the tallest trees and are usually over 50 metres tall. The Kapok tree is an example of an emergent.
3. The sea of leaves blocking out the sun from the lower layers is called the **canopy**. The canopy contains over 50% of the rainforest wildlife. This includes birds, snakes and monkeys. Lianas (vines) climb to the canopy to reach sun light. Epiphytes, or air plants, are also found in this layer. An epiphyte is an organism that grows on the surface of a plant and gets its moisture and nutrients from the air, rain, water or from debris gathering around it.
4. The **under canopy** mainly contains bare tree trunks and lianas. Lianas are vines that climb the vegetation in a bid to reach sunlight.
5. The **shrub layer** has the densest plant growth. It contains shrubs and ferns and other plants needing less light. Saplings of emergent and canopy trees can also be found here.
6. The **forest floor** is usually dark and damp. It contains a layer of rotting leaves and dead animals called litter. This decomposes rapidly (within 6 weeks) to form a thin humus, rich in nutrients. Below the rich top soil, the soil lacks nutrients. This is because nutrients are rapidly absorbed by vegetation.
7. Climate:
  - Very wet with over 2,000 mm of rainfall per year.
  - Very warm with an average daily temperature of 28°C. The temperature never drops below 20°C and rarely exceeds 35°C.
  - The atmosphere is hot and humid.
  - The climate is consistent all year round. There are no seasons.Weather:
  - Heavy rainfall in the afternoon

- High temperatures
  - Humid conditions
8. Soil:
- Most of the soil is not very fertile.
  - A thin layer of fertile soil is found at the surface where the dead leaves decompose.
  - It is red in colour because it is rich in iron.
  - Due to heavy rainfall the nutrients are quickly washed out of the soil.
9. Biodiversity:
- The warm and very wet climate provides perfect conditions for plant growth.
  - The wide range of plant species supports many different animals, birds and insects.
  - Species have **adapted** to the conditions of the rainforest, e.g. trees and plants have shallow-reaching roots to absorb nutrients from the thin fertile layer in the soil.

---

## TROPICAL RAINFOREST – INTERDEPENDENCE AND ADAPTATIONS

1. Climate, water, soils, plants, animals and people.
2. The diagram should show clear links illustrating how the six features are interdependent, for example plants are dependent on water in order to support growth etc.
3. Any of the following:
  - Emergents
  - Drip tips
  - Waxy leaves
  - Epiphytes
  - Smooth trunks
  - Thin bark
  - Wide buttress roots
  - Flexible leaf stems
4. Any of the following:
  - Plants in the highest layer (emergent) only have branches at their crown (where the most light reaches them), and plants in the under canopy have large leaves to absorb as much light as possible to support photosynthesis.
  - In the tropical rainforest, most trees in the rainforest have wide buttress roots. This is to support them as they grow incredibly tall (over 20-40m in some cases) as there is great competition for sunlight. In addition to this roots grow wide rather than deep because nutrients are found in the top layer of soil.
  - Epiphytes are plants that grow on the surface of another plant. It gets its moisture and nutrients from the air, rain, water or from debris accumulating around it.
  - Lianas (vines) grow around trees as they climb to reach sunlight.
  - Tree bark in the tropical rainforest is typically thin. This is because the temperature throughout the year is typically between 26-28°C. Therefore, they do not need protecting from the cold.
  - Plants drop their leaves gradually throughout the year, meaning they can go on growing all year round.
  - Many trees have smooth, thin bark as there is no need to protect the trunk from cold temperatures. The smooth surface also allows water to run off easily to the soil, so the tree can absorb the water.

- Additionally, smooth trunks reduce the risk of epiphytes growing on a tree as they have nothing to attach themselves to. This helps protect the tree from the risk of collapse under the weight of epiphytes.
  - Plants have thick, waxy leaves with pointed tips. The pointed tips (called drip-tips) channel the water to a point so it runs off – that way the weight of the water doesn't damage the plant, and there's no standing water for fungi and bacteria to grow in. The waxy coating of the leaves also helps repel rain.
  - Leaf stems are flexible to allow leaves to move with the sun to maximise photosynthesis.
5. Identify 3 ways animals have adapted to the rainforest environment.
- Prehensile tail
  - Bright colour
  - Nocturnal
  - Sharp claws
  - Sticky foot pads
  - Camouflage
6. Explain 3 ways animals has adapted to the rainforest environment.

#### Poison Dart Frog

The poison dart frog is known for its bright colour, however, in the animal world, this signifies dangers. The poison dart frog excretes poison through its skin and its bright colour warns potential predators against eating it. Some of the frogs in this family are not poisonous however, they have adapted to their environment by copying the appearance of the poisonous types.

#### Sloth

Sloths have adapted to the rainforest ecosystem in a number of ways. Two-toed sloths are nocturnal which enables them to avoid **diurnal** (or active during the day) predators, by sleeping during the day. Although three-toed **sloths** are both diurnal and **nocturnal**, they're largely inactive during the day. Sloths are built for life in the trees because their arms are longer than their legs and their feet are curved which helps them grasp branches. Sloths move very slowly which helps them avoid being seen by predators.

Three-toed sloths have tan coats, while two-toed sloths usually have grey-brown fur. These tones match tree trunks and branches providing camouflage. Additionally, they grow algae in their fur which contributes to their camouflage.

Three-toed sloths have three extra neck bones which allow them to turn their heads 270° which is a useful adaptation when predators can come from any direction.

Sloths have thick, dense coats which keeps them dry during heavy downpours. An undercoat protects their skin which their long outer hairs hang down providing a natural route for the water to flow off the animal.

Sloths have long, sharp claws that help them cling onto branches. Combined with their sharp teeth, these claws are also used to defend themselves from predators such as anacondas, boas, wild cats, eagles and hawks.

Sloths have a very slow metabolism which enables them to stay in the same tree for several days before descending for food. It also means they only defecate (poo!) every eight days which is important because they do this on the forest floor, saving them valuable time and energy.

### Spider Monkey

The main physical adaptation of the spider monkey is its prehensile tail. The prehensile tail allows the spider monkey to be able to grasp the branches of trees. The prehensile tail is longer than the monkeys' body and composed of twenty-three vertebra. This gives it suppleness and strength. The monkey can hang by its tail, swing by it, pick fruit with it and even throw things with it.

Spider monkeys have a highly developed larynx, which gives the ability to produce a range of vocal sounds. They use these to communicate across the treetops as they are very sociable animals.

### Gecko

There are now more than 2,000 different species of geckos living in various parts of the world. Each one has altered its appearance, or other physical features, in order to survive in a hostile world. In the tropical rainforest, geckos are green which provides camouflage in three tops where they dwell.

Geckos have developed large, flattened toe pads that have sticky scales on their undersides. These help them grip onto the smooth tree trunks that are commonly found in the rainforest allowing them to climb vertically up trees.

The gecko's tail has evolved to become easily detached allowing it to escape if caught by a predator.

### Jaguar

Jaguars have adapted to the wet environment of the tropical rainforest. They are very good swimmers, and unlike other cats, they seek out water for bathing and swimming.

The jaguar's fur keeps it camouflaged in the tropical rainforest. Jaguars are also very strong, giving it the strength to move slowly and silently through the forest when stalking prey. The jaguar can move extremely fast which makes it an effective hunter.

Jaguars have developed large claws which enable them to climb small trees and catch their prey.

**There are many other animals that have adapted to the rainforest environment which are equally valid if your answer is not included here.**

---

## TROPICAL RAINFOREST – DEFORESTATION

1. The rate of rainforest deforestation around the world has increased over time. Around half of the world's tropical rainforest has now been cleared. Rates of deforestation increased in all three continents containing tropical rainforest. These were Asia (Indonesia, Thailand and Malaysia), Africa (Mali and Madagascar) and South America (Bolivia, Guatemala and Peru). The rate of deforestation in Indonesia and Peru is alarming. The rate of deforestation in Indonesia was twice as great between 2005 and 2010 compared to 2000 and 2005. In Peru, it nearly doubled.

The rate of deforestation declined in seven countries. Deforestation in Brazil has fallen to a record low. Over half of the remaining rainforest in Brazil is in some way protected. However, an area three times the size of the UK has been cleared since 1970. This accounts for 20% of the original forest.

2. Examples will include the Amazon, Borneo, Malaysia and Indonesia. There are many other locations that can be included.
3. Slash and burn, road construction, logging, cattle ranching, mining, hydroelectric power and farming.
4. Examples include:

### **Slash and burn**

Most clearances are still by the local people and tribes needing land on which to grow crops. They clear the forest by 'slash and burn'. Vegetation is cut down and then burned. The ash acts as a fertiliser adding nutrients to the soil. When the soil begins to turn infertile (usually after 3-5 years) the people move on. This is called shifting cultivation. It is a sustainable method of farming in the rainforest. It ensures the forest will recover.

### **Road Building**

The Transamazon Highway has allowed increased access to the Amazon Rainforest.

### **Logging**

Commercial logging is the major cause of primary rainforest destruction in South East Asia and Africa. Worldwide, it is responsible for the destruction of 5 million ha. per year. Logging roads enable landless people to enter the forest. In Africa, 75% of land being cleared by peasant farmers has been previously logged.

### **Cattle Ranching**

Ranching is a major cause of deforestation, particularly in Central and South America. In Central America, two-thirds of lowland tropical forests have been turned into pasture since 1950.

### **Hydroelectric Power**

An unlimited supply of water and ideal river conditions have led to the development of hydroelectric power stations (HEP Stations).

### **Farming**

There are nearly 3 million landless people in Brazil alone. The government has cleared large areas of the Amazon Rainforest and encouraged people to move there. The scheme has not been successful. Farmers stay on the same land and attempt to farm it year after year. Nutrients in the soil are quickly exhausted as there is no longer a humus layer to provide nutrients. The soil becomes infertile and nothing will grow.

### **Mining**

The mining of iron ore, bauxite, gold, oil and other minerals have benefited many LEDCs. However, it has also devastated large areas of rainforest e.g. The Amazon.

### **Population**

Population growth has resulted in the loss of tropical rainforest as land is cleared to build houses and infrastructure.

5. Impacts of deforestation include:

- Soil erosion
- Loss of biodiversity
- Climate change
- Economic development
- Loss of natural habitat
- Loss of native people's lands

6. Examples can include:

- **Soil erosion**

When land is cleared of rainforest vegetation the soil is left bare. When it rains, the nutrients in the soil are washed (leached) away. The nutrient cycle stops because there are

no plants or trees shedding leaves to replace the nutrients in the soil. The soil is no longer able to support plant life because it is not fertile. The roots of plants and trees no longer hold the soil together, so it is easily eroded.

- **Loss of biodiversity**

Many different species of plants and animals die because of deforestation. As plants and animals are closely connected through the food web, deforestation this reduces the biodiversity, or variety of species found in the tropical rainforest.

- **Climate change**

The trees and plants of the Amazon Basin absorb carbon dioxide during the process of photosynthesis. If there are fewer trees and plants, due to deforestation, then less carbon dioxide is removed from the atmosphere. In this way deforestation contributes to global warming and therefore climate change.

- **Economic development**

The creation of mines, farms and roads - which caused deforestation - has also led to economic development. The money created from these enterprises allows a country to generate foreign income, which can then be used to pay off debts or be invested in further development projects.

---

## TROPICAL RAINFOREST – SUSTAINABLE MANAGEMENT

1. Three local sustainable strategies include:

- Afforestation
- Shifting cultivation
- Rubber tapping
- Selective logging
- Agroforestry

2. Answers can include:

- **Afforestation** – the opposite of deforestation. If trees are cut down, they are replaced to maintain the canopy.
- **Shifting Cultivation** – Farmers should move on after 2-3 years to allow the rainforest to recover.
- **Rubber tapping** – More sustainable methods of exploiting the rainforest should be pursued e.g. rubber tapping.
- **Selective Logging** – Only certain trees (e.g. just the older or inferior ones) are cut down – most trees in the area are left standing. This causes less damage as the trees that remain provide soil cover, avoiding leaching of nutrients and soil erosion and protecting the nutrient cycle. Selective logging allows young trees a guaranteed life span and the forest will regain full maturity after around 30-50 years. This maintains the health of the forest and ensures it can be used by future generations.
- In some areas horse logging is used which involves horses dragging the felled trees out of the rainforest which is more environmentally friendly than using heavy machinery. Helicopter logging is also an alternative to using heavy machinery to extract timber. This occurs in the Malaysian state of Sarawak.
- **Agroforestry** – growing trees and crops at the same time. This lets farmers take advantage of shelter from the canopy of trees. It prevents soil erosion and the crops benefit from the nutrients from the dead organic matter.

3. International strategies include:

- Debt reduction programmes
- International Agreements

4. Explanations could include:

- **Debt reduction programme** – Many tropical rainforests are located in LICs. Many LICs are heavily in debt and often use natural resources such as the rainforest as a way of making money to pay off loans. However, there have been instances when wealthier countries have agreed to write off the debt in return for protecting the rainforest. In 2010 The USA and Brazil signed an agreement converting \$21m (£13.5m) of Brazilian debt into a fund to protect tropical ecosystems. Instead of paying back the debt, Brazil will use the money to conserve its Atlantic coastal rainforest, as well as the Cerrado and Caatinga ecosystems.
- **International Agreements** – Tropical hardwood, such as mahogany, is in high demand in richer countries to make things like furniture. This high demand is leading to increased rates of illegal deforestation. To overcome this international agreements are in place to restrict wood that is not from a sustainable sourced being imported into countries. An example of this is FSC. The Forest Stewardship council source sustainable timber and mark these products with their logo so people buying the wood know that the wood is sustainably sourced.

**You will have studied either a hot desert or a cold environment for your second ecosystem. Complete the appropriate questions from the two sections below.**

## Hot Deserts

### HOT DESERTS – THE CHARACTERISTICS OF HOT DESERTS

1. Hot deserts are mainly found around the Tropics of Cancer and Capricorn. The hot deserts of the world are located between 15° and 30° **north** or south of the equator. The largest hot desert is the **Sahara** in Africa which spans the whole width of the continent. Deserts are typically found towards the west coast of continents.
2. Climate:  
The climate is very **hot**. Hot deserts have two distinct seasons: **summer**, when the temperature ranges between 35-40°C, and **winter**, when the temperature ranges between 20-30°C.  
The climate is very **dry** with less than 250 mm of rainfall a year.  
Weather:  
Summer day time temperatures can exceed 40°C. However, at night the temperature can drop below 0°C. Little or no rainfall occurs during the day.
3. Characteristics of soil include:
  - Desert soils are thin, sandy, rocky and generally grey in colour.
  - Desert soils are very dry. They soak up water quickly when it does rain.
  - The surface of the soil may appear crusty. This is due to the lack of rainfall. As it is so hot water is drawn up to the surface of the soil by evaporation. As the water evaporates, salts are left behind on the surface of the soil.
4. The hot, dry climate is not suitable for many types of life.

## HOT DESERTS – INTERDEPENDENCE AND ADAPTATIONS

1. Climate, water, soils, plants, animals and humans
2. The diagram should show clear links illustrating how the six features are interdependent, for example plants have developed the ability to store water due to the lack of rainfall.
3. Xerophytic.
4. Examples may include:
  - Deep roots
  - Shallow roots
  - Small leaves
  - Short life cycles
  - Spines
  - Succulents
  - Wax coated leaves
5. Explanations may include:
  - Vegetation has leaves that are very small (and only grow after it rains) or have no leaves at all. This helps to reduce water loss;
  - Plants either have long root systems spread out wide or go deep into the ground to absorb water;
  - Plants have short life cycles. They germinate following rainfall, grow, flower and die within a short space of time e.g. one year. This helps them avoid drought
  - Some plants have spines to discourage animals from eating plants for water and reduce water loss through transpiration;
  - Many plants are slow growing – this requires less energy. The plants don't have to make as much food and therefore do not lose as much water.
  - Some plants are succulents and store the water in their leaves, stems or roots. An example of this is the cactus.
  - Cacti also have spines instead of leaves. These minimise surface area and helps reduce moisture loss through transpiration during the day. The spines also protect the cacti from being eaten by animals. They also have a waxy coating on stems to help reduce water loss.
  - Cacti have widespread root systems, located close to the surface that can collect water from a large area.
  - Other ways plants tolerate the dry conditions include:
    - **long roots** to tap into the water deep underground
    - **short life cycles** – a plant or seed could remain dormant until the rains come
6. Animals could include:
  - Camels
  - Desert fox
  - Kangaroo Rat

7. Explain 3 ways animals have adapted to the hot desert environment.

### Camels

- long eye lashes, hairy ears and closing nostrils help to keep out sand
- thick eyebrows which stand out and shade eyes from the sun
- wide feet so they don't sink in the sand
- they can go without water for over a week because they can drink gallons in one go
- they can go months without food - they store fat in their humps
- body temperature can change to avoid losing water through sweating

- they are well camouflaged
- thick fur helps to keep them warm at night

#### Desert Fox

- Desert foxes have thick fur on the soles of their feet, protecting them from the hot ground.
- The light-coloured fur on their bodies reflects sunlight and keeps them cool.
- Burrow to escape the heat.
- Nocturnal animals sleep during the day, sheltering to help prevent dehydration.
- Animals may hibernate during temperature highs or lows.

#### Kangaroo Rat

- Kangaroo rats do not need to drink water; they get it from food.
- They live in burrows during the day to avoid extreme heat.
- They do not perspire and have highly efficient

---

### HOT DESERTS – OPPORTUNITIES AND CHALLENGES

1. Examples will include Great Western, Mojave, Sahara and Thar.
2. An appropriate description of location will include latitude and longitude data, continent, country and its location within in each.
3. Examples will include: mineral extraction, energy, farming and tourism
4. Each explanation will give a clear outline how the activity provides a development opportunity including generating an income for the area, creating jobs, infrastructure development and business opportunities for local people.
5. Development challenges will include: extreme temperatures, lack of water, low population density, inaccessibility and provision of buildings and infrastructure
6. Each explanation will give a clear overview of how development is challenged. For example, extreme temperatures make water availability very limited which makes the environment very difficult to live in. This makes it hard to recruit people to work in industry.

---

### HOT DESERTS – DESERTIFICATION

1. Desertification is the process of fertile land turning into desert over time. Areas on the edge of hot deserts are especially at risk of desertification.
2. Answers could include climate change, removal of trees for fuel, overgrazing, over-cultivation and population growth.
3. Answers could include:
  - Climate Change – hotter and drier conditions are increasing the risk of land turning to desert;
  - Removal of trees for fuel – cutting down trees to use the wood for fuel leads to roots dying. The soil will no longer be held together by the roots and erosion will occur;
  - Overgrazing – soil becomes bare as the result of vegetation being removed by grazing animals. The soil becomes bare, compacted and prone to drying out and cracking;
  - Over-cultivation – as a population grows there is a greater demand for food. Farming becomes more intensive which means the land has less chance to recover causing it to become infertile, exposed and at risk of erosion; and
  - Population growth – rising population puts a great demand on resources.
4. Identify four strategies to reduce desertification.

5. Explain how these strategies reduce desertification.
  - Water and soil management – planting and harvesting appropriate crops ensure the soil can recover. Small-scale irrigation projects, such as catching and storing rainwater and using sprinklers to irrigate the land.
  - Tree planting – This helps reduce soil erosion because tree roots stabilise the soil. Find out about a scheme in the Sahel to combat desertification through afforestation – the Great Green Wall of Africa
  - Planting pits or Zai – planting pits are simple irrigation systems used to hold more water around the plant. The planting pit a small pit used to grow crops and catch water. They include half-moon water catchments. Water gathers in the depression and helps water the plant over time. Homemade compost is used to provide a fertility boost for the soil.
  - Appropriate technology – this involves the use of technology or techniques that can be easily used or replaced by locals. For example, stone lines along the soil contours keep it in place, prevent erosion and improve crop yields. Projects such as this can involve the whole community and give them a sense of ownership and responsibility.

## Cold Environments

---

### COLD ENVIRONMENTS – THE CHARACTERISTICS OF COLD ENVIRONMENTS

1. These are found in inland areas, far from the warming influence of the sea. They include Greenland, Northern Canada, Northern Russia (Siberia) and Antarctica.
2. Below
3. They are found south of the ice caps in the northern hemisphere. They occupy around one-fifth of the Earth's land surface, including enormous areas of Russia and Canada.
4. Permafrost
5. Low-lying shrubs and mosses.
6. Day time temperatures rarely reach 10°C. The average temperature usually remains below freezing. Precipitation mainly falls as snow. Overall, there is little precipitation because cold air cannot hold much water vapour.
7. The growing season lasts just 6-10 weeks. Summers are short and cool with sunshine 24 hours a day. In winter temperatures fall below -40°C. Average temperatures nudge above freezing for just one month a year in the coldest environments. Precipitation falls as snow in the winter and rain during the brief summer. The total annual amount of precipitation is low due to the cold air temperature.
8.  $\frac{1}{4}$
9. Ice in the most active layer thaws for one or two months during the summer season. However, there is still ice below the active layer which acts as an impermeable barrier to the downward movement of melt water in the soil layer above. This leads to waterlogged conditions.

---

### COLD ENVIRONMENTS – INTERDEPENDENCE AND ADAPTATIONS

1. Climate, permafrost, soils, plants, animals and humans
2. Interdependence links may include:
  - Tundra birds and small mammals use moss to line their nests for warmth against the icy wind.

- Traditionally, Inupiat and Yup'ik people of the Arctic Circle depended on animal skin and feathers for their clothing
  - Historically, indigenous people in coastal areas have depended on marine species (including fish, sharks and whales) for food and other uses
3. Identify 3 ways vegetation has adapted to cold environments.
    - Low lying vegetation
    - Hairy stems
    - Small seeds
    - No need for soil for growth
  4. Explain 3 ways vegetation has adapted to cold environments.
    - Low lying vegetation helps to protect the soil from wind erosion. It can also trap airborne dust and use it as a source of nutrients.
    - **Arctic poppy** - this has a hairy stem to retain heat. The flower can track the sun in the sky to maximise the amount of sunlight it receives so that it can increase photosynthesis.
    - **Cotton grass** - this grass has small seeds that can easily be dispersed by the wind to ensure its survival. It is low lying to protect it from cold winds and has thin leaves to reduce water loss by transpiration. Cotton grass grows and produces seeds quickly as soon as the temperature increases.
    - **Lichen** - this organism does not need soil to grow. It grows very slowly, can withstand very cold temperatures and survives beneath snow.
  5. Identify 3 animals that have adapted to cold environments.
    - Snowshoe rabbits
    - Caribou
    - Musk Ox
    - Polar Bear
  6. Explain 3 ways animals have adapted to cold environments.
    - Snowshoe rabbits  
Snowshoe rabbits have white fur. This means they cannot easily be seen against the winter snow.
    - Caribou  
Caribou have two layers of fur to help them survive the cold. They have large hooves to help them travel over soggy ground and break through ice to find drinking water during the winter months.
    - Musk Ox  
Musk Ox have two layers of fur to help them survive the bitter cold. They also have large hooves to help them travel over soggy ground and break through ice to find drinking water during the winter months.
    - Polar Bear  
They hibernate in winter to protect themselves from the cold.  
They are insulated by fat so they do not freeze.  
They have white fur which provides camouflage against snow and ice.

---

## COLD ENVIRONMENTS – OPPORTUNITIES AND CHALLENGES

1. Examples could include Alaska, Siberia, Greenland and Antarctica
2. An appropriate description of location will include latitude and longitude data, continent, country and its location within in each.

3. Opportunities in cold environments could include mineral extraction, energy, fishing and tourism.
4. Opportunities include:
  - **Mineral extraction** - reserves of gold, silver, iron ore and copper can all be found in cold environments. These minerals are very valuable and countries are increasingly seeking to mine from under tundra. Russia has already started exploiting resources in this way.
  - **Energy** – oil and gas are abundant in cold environments. Oil is being extracted from Alaskan Oilfield in Alaska near Prudhoe bay. Permafrost has melted as the result of heat from the terminal buildings, workers' houses and transporting warm oil through the 800 km pipeline.
  - **Fishing** – fish stocks are good in the coastal waters of cold environments. Due to the pressure of global population growth and reducing fish stocks in other parts of the world these waters are increasingly attractive for commercial fishing.
  - **Tourism** - cold environments have seen a huge increase in the number of tourists. Over 36,000 tourists visited Antarctica in 2014 to observe its wildlife and experience its beautiful wilderness.
5. Development challenges include the extreme temperature, relief, buildings and infrastructure.
6. Cold environments provide development challenges because:
  - **Extreme temperature** - very low temperatures and long hours of darkness make building very difficult. These conditions are also undesirable for many people which means few want to work there.
  - **Relief** – mountainous relief make some cold environments very inaccessible for vehicles delivering supplies and materials for construction.
  - **Buildings** – if permafrost melts the ground becomes very unstable. This can make existing structures collapse. Also, it makes creating foundations for new buildings very difficult making development very challenging.
  - **Infrastructure** – constructing roads, railways, providing fresh water supplies, sanitation and energy is very challenging in cold environments which restricts economic development.

---

## COLD ENVIRONMENTS – THE RISK OF ECONOMIC DEVELOPMENT

1. Reasons could include:
  - extreme cold temperatures and lack of sunlight in northern locations in the northern hemisphere
  - the low carrying capacity of the land, the short thermal growing season rules out crop production so people tend to settle along coastal areas where they can fish and hunt for seals
  - unequal distribution of infrastructure
  - thermokarst – uneven ground
  - seasonal melting of the active layer makes it difficult for construction in some areas
2. The risks will be determined by the location studied. Four risks for Alaska could include:
  - The risk of the oil pipeline breaking, releasing oil into the environment
  - The risk of oil tankers running aground
  - The risk of the oil pipeline blocking migration routes of animals such as caribou
  - The risk of the oil pipeline melting the permafrost
  - Drilling for oil presents a significant risk of a spill that could affect the fish stocks that local people depend on
3. Strategies include:

- Insulating the pipeline to reduce the risk of melting permafrost
  - Placing parts of the pipeline underground so as not to interrupt migration routes
  - Drilling is not allowed in environmentally sensitive areas such as off the coast of Kaktovik and Barrow.
  - Drilling is not allowed on land in environmentally sensitive locations
4. It can be balanced through:
- Wireless radio and satellite links were provided for all the main populated areas, although coverage remains very uneven. As a result, many isolated parts of Alaska have been able to 'leapfrog' forwards in terms of their access to technology.
  - People can now receive a mobile phone call in places where landlines are still absent.
  - Video conferencing can be used to teach children in remote communities
  - Degrees can be completed online
  - Culture, such as that of the Inuit, can be recorded using a database (Alaska Native Knowledge Network)
5. Global technology companies relocating to cold environments because:
- Data centres need air condition to keep them cool. By locating in a cold environment cold air can be pumped around the data centre and is much cheaper than air conditioning.
  - Low HEP costs in some cold environments make them attractive destinations for power hungry data storage sites.
  - Glacially eroded valleys have flat floors, ideal for building on
6. International solutions include:
- International agreements and treaties can influence what happens in cold environments such as the International Whaling Convention, Antarctic Treaty and the formation of the Arctic Council.
-